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DIAMONDS.

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QUOTING the words of Pliny we can say: "*Maximum in rebus humanis, non solum inter gemmas, pretium habet adamas.*"[1]

As far as our reliable records reach back into the dim and mystic ages, we find the diamond occupying a prominent position in the estimation of man. Above all other of its qualities, which at present determine its value, the superior hardness to all substances then known, seems to have impressed the Ancients. There appears to be but little doubt, that at very early ages the East Indians and the original inhabitants of the Chinese Empire knew the value of diamonds over all other gems. It is supposable, too, that the art of cutting was known to them, although it was not employed in the western countries until many centuries later.

Some doubt may appear whether the ancient Hebrews really possessed the diamond. In translations the word "shâmir" is rendered as diamond. We find that the breast-plate of the High Priest contained a "diamond" in the second row of precious stones. We furthermore find, however, that these twelve stones "were according to the names of the children of Israel," . . . "like the engravings of a signet, every one with his name, according to the twelve tribes." It seems improbable that they should have been able to engrave the diamond. Other passages occur where the diamond is used as a symbol of greatest hardness. One allusion is made that shows its application in the art of engraving; Jeremiah says: "The sin of Judah is written with a pen of iron and with the point of a diamond; it is graven upon the table of their heart." *Corundum* was known to the Hebrews, and the comparative paucity of direct references to the diamond may lead to the supposition that some one of the corundum minerals was thereby meant. If a diamond was really spoken of, then this is one of the oldest reliable mentions made (600 B. C.).

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[1] Among all human things, not only among gems, the diamond is the most precious.

Among the Greeks, Homer (1000 B. C.) uses the word "*Αδάμας*," but in his writings it signifies steel. There is no evidence that the precious stone known 600 years later, under the name of adamas, was among those with which Homer was acquainted.

Hesiodus, living about an hundred years later than Homer, uses the same word, but it merely designates some—to his mind—indestructible metal. Thus the sickle of Chronos, the helmet of Heracles, the chains binding Prometheus, and other similar instruments were composed of adamas. Roman poets and other writers have copied the idea and have constructed the gates to Hades and other durable objects from the same material. An interesting analogy, although a purely poetical one, may be found in the fact that the first seal rings, *Sphragides* of the Greeks, were manufactured from the chains confining Prometheus. The stones set into them were obtained from the rock to which the unfortunate thief was bound. Thus did man honor him who conferred a lasting boon by stealing fire from the irate Jupiter.

Later on, the term adamas was applied to the diamond. There is evidence extant showing that the cutting qualities of diamonds were utilized in Greece and Asia Minor about 400 years before Christ. Owing to the fact that no mineral or metal could produce any graven impression upon the diamond, it took the name above given, which literally means "not conquerable." Pliny adopted it, as did others of the more recent Roman writers. The former furnishes a learned description of the gem and its peculiar qualities, while the latter use the word to express a very high degree of hardness.

Pliny (born A. D. 23), states that six species of adamas are known. Of these five are probably only minute flakes of gold contained in some other mineral. The last one, however, he mentions as not occurring with gold, but found in India, in the form of crystals. From his description of the crystalline forms, the specimens he had under consideration might as well have been quartz as diamond. As he was acquainted with rock-crystal, however, and describes it elsewhere, we may conclude that he meant the diamond. Pliny had a very thorough appreciation of its hardness, and repeats the fable then current, with reference thereto. He states that an adamas laid upon a new anvil, and struck with a new hammer, will shiver both, while the gem remains intact. Only by sprinkling it with the fresh blood of a male goat, can the excessive hardness be conquered. When the adamas is thus broken, however, it is shattered into innumerable small fragments so minute, indeed, that they can scarcely be seen with the naked eye. Bishop Albertus Magnus, of Southern Germany, in 1260, repeats the same statement, and sententiously adds, that the blood of the animal became far more efficacious, if he had imbibed sour wine and eaten some parsley just before being killed.

Owing to the rarity of the mineral this fable could be perpetuated for more than 1400 years, in countries far removed from those where the diamond was originally found.

After expressing his surprise that so disagreeable an animal as the goat should have so great a power over this most precious stone, Pliny states, that small splinters of diamond are set in iron holders, and used for the purposes of engraving and drilling. This shows a remarkable coincidence with the utterances of Jeremiah more than 600 years earlier.

At the time of Charles the Great (768 to 814) diamonds were highly prized as ornaments, and ever since that time they have steadily advanced in demand until the present day. During the reign of Louis XIV, in France, diamonds were much sought after, and some were brought to light that are famous for their beauty even now. Having at that time made an enormous stride in the favor of all people admiring mineral ornaments, diamonds have since then maintained their position. To-day they are a staple article in the market, and although new discoveries may somewhat affect their value, the demand is sufficiently great and constant to render them one of the most valuable among the precious stones.

Of all the countries which have furnished diamonds, India has been known as a prolific source for the longest period of time. Perhaps the most famous of all diamond fields there are the Golconda Mines. Thousands of people have found and many still do find employment there, although much of the wealth has already been exhausted. During the reign of Louis XIV, Tavernier visited the Orient to collect diamonds and precious stones for his king. At that time (about 1680) he found 60,000 persons engaged in searching for diamonds in the mines of Ellore, in India. Next to India in importance is South America. The mines in Brazil were opened in 1727, and the best of them are situated north of the Rio Janeiro. On the Rio Jequitinhonha and Rio Pardo the most remunerative fields are found. Other placiers have yielded very good diamonds, however.

On Borneo, in the Ural Mountains, and in Australia, diamonds have been found. In the United States they have been collected at several localities, but only in comparatively isolated specimens. Diamonds have been obtained from North Carolina, Georgia, Virginia and California. The notorious occurrence of these precious stones in what was termed the "Arizona diamond fields," situated in North-western Colorado, is probably still too fresh in the memory of everybody to require special mention. Diamonds were certainly found there, but, to use a popular phrase, "they had not grown there."

Recently discoveries of extensive diamond fields have been made in Africa. They are situated on and near the Orange and Vaal Rivers, and are being worked with energy. Although their discovery dates back but a comparatively short time, it appears that the existence of diamonds there was already known during the last century. According to Dr. J. W. Morton, the natives have for a long time used diamonds from this locality to drill their stones, and formerly made periodical visits to replenish their supply of material.

As is frequently the case, the present impetus in that region to mining operations was given by the accidental discovery of a diamond. It was found in the hands of some children who were playing with the pretty pebble.

Wherever diamonds are found, they occur in redeposited material. River-drift or boulder-clay may contain them. No matrix for them has been recognized with certainty as yet, although it is claimed that the Itacolumite (flexible sandstone) of Brazil contains them. This assertion is scarcely proved, however, and even if it were so, this very Itacolumite is but the product of re-deposition. It may be regarded as a significant fact, perhaps, that the localities of North Carolina and Georgia, where diamonds have been found, are not far removed from occurrences of flexible sandstone. In the South African diamond fields the gems are contained in a conglomeritic mass. It is composed mainly of volcanic material, but has evidently been deposited by water. In its general, physical character it may be compared to the "blue cement" of California, which is auriferous.

Of all these localities mentioned, India has produced by far the greatest number of celebrated diamonds. The largest diamond of which we have any knowledge, is mentioned by Tavernier. It was found in 1550, was in the possession of the Great Mogul at the time of Taverniers visit, and weighed 900 carats (1 Parisian carat = $205.5^{\text{mgr.}}$). The present "Great Mogul" weighs 279 carats, and may be a portion of the original one.

Ko-hi-noor.—Tavernier gives the weight of the original Ko-hi-noor ("mountain of light") as being 787½ carats, but other reports place it a little higher. Weighing 186½ carats it came into the possession of the British crown, but was considerably reduced by cutting. Lately it has been recut, from rosette form to that of a brilliant, and now weighs only 106 carats.

Orloff.—The Orloff, weighing 194¾ carats, is in the possession of the Russian crown. It was purchased by Katharine II, for 450,000 silver roubles and 4000 roubles annuity. This diamond is cut in rosette-form.

The Persian.—In 1832 a diamond was found in the hut of a Persian peasant, by a traveler. It was there utilized for the purpose of striking fire. He purchased the stone and sold it at a high price. The weight of the "Persian" is 130 carats.

In connection with these three diamonds a very interesting observation was made by Mr. Tennant. The Ko-hi-noor, in its first cut, showed two natural planes of cleavage, the Orloff still shows one, and the Persian one. By reproducing as nearly as possible the original shapes of these diamonds, it was found that they probably are three fragments of one very large one. The aggregate weight would be 510¼ carats. It is quite possible, therefore, that these three formed the original Ko-hi-noor, the pride of Eastern nations. Tavernier mentions the fact that it had been cut down from its original size, which might account for the difference in weight. Few, if any gems have so prominent a position in legendary history as the original Ko-hi-noor. More than 5000 years ago the East Indian hero Kama, is said to have worn it in the "great war" (Maha Bharata). The discovery of the Persian led to the above results, as it was, to a certain extent, the incentive to the comparison.

Regent.—By far the most beautiful diamond of the French treasury is the " Regent " or " Pitt." From its original weight of 410 carats it has been cut down to 136¼. Its absolute purity and the elegance of its cutting (brilliant) for a long time placed it highest in rank among all the known diamonds. Its earliest history is somewhat obscure. According to tradition a slave found it in 1702 in Golconda. In order to hide it from the eyes of his employers he wounded himself in the thigh and placed the huge diamond within the wound. Having confided the secret of his treasure to a sailor, he accompanied him to sea. The sailor, however, stole the diamond and threw the slave overboard. In England the sailor sold it for 1000 pounds, lived merrily until his money was all gone, and then hung himself. Louis XV. of France bought it for two and a half millions of francs ($500,000). During the French Revolution, September 17, 1792, the crown diamonds were stolen, the Regent among them. Through the agency of an anonymous letter they were again discovered, hidden in a ditch in the Champs Elyseès. Although the Regent and many others were thus recovered, some of the most valuable stones could not then be found, among them the Sançy. After that the French Republic placed it in pawn with a merchant in Berlin. Napoleon Bonaparte recovered it again and had it set into the hilt of his favorite sword. Since that time it has remained in possession of the French government.

Sancy.—The Sançy first appears as the property of Charles of Burgundy. He lost the diamond in the battle of Nancy, 1477. Soon after this it came into the possession of Count Nicolas de Sançy. During 1589, Count de Sançy was in Switzerland, at a time when Henry III of France required securities for some loans he was then making. His loyal vassal immediately dispatched a trusted servant with the Sançy diamond as an offering to his king. Nothing was heard of the servant for a long time. Investigations showed that he had been waylaid and murdered. As his last resource, however, to save the property of his master he had swallowed the diamond, which was found after his body had been recovered. Later it formed part of the crown-jewels and was stolen, together with the Regent in 1792. After having been lost to observation for a long time the Sançy again reappeared in the family of the Napoleonids, who sold it to the Emperor of Russia for a half million francs, in 1830. This diamond weighs 53¾ carats and is cut in rosette shape.

Among the most prominent diamonds of earlier times are several that are noted for their color.

Florentine Diamond.—This stone is of a lemon-yellow color and weighs 133 3-5 carats. It was at one time the property of Charles of Burgundy, who wore it in his helmet. In the battle of Granson, on Neufchatel Lake, he lost it. A Swiss soldier picked it up and sold it to a priest. Pope Julius II. finally obtained it for 20,000 ducats, and eventually it was acquired by the Austrian crown, where it is to-day.

Dresden Diamond.—A very handsome green diamond is owned by the Saxon crown, and is preserved in the Green Vaults at Dresden. The color is a bright green with a bluish tinge; its weight 31¼ carats.

Hope Diamond.—Banker Hope, of Amsterdam, possesses a fine blue diamond of 4½ carats. It is cut in brilliant form, and closely resembles a deep blue sapphire in color. Formerly a blue diamond of 67 carats was among the crown-jewels of France, but it disappeared during the revolution.

Within recent years the two largest diamonds have been found in Brazil and Africa respectively.

Star of the South.—This diamond was found in Brazil in 1853, by a negress. Its original weight was 247½ carats, but by cutting it was reduced to 125 carats. The "Star of the South" has a slight pink tinge.

Star of South Africa.—About ten years ago this diamond was purchased from a native, and sold at once for 56,000 dollars.

Cutting.—It is evident that a large proportion of the value of a diamond depends upon the preparation it undergoes, in order to develop its beauty. No evidence is on hand to show that any of the ancient nations, East Indians and Chinese excepted, were acquainted with the art of diamond-cutting. From its very superior hardness, it is natural that it can be cut by no other material. In 1373 there was an association of "diamond-polishers" at Nuremberg, in Germany, but not until 1456 was cutting and polishing carried on as an art. Louis van Berquen, in Holland, at that time proceeded to rub two diamonds together, and finally produced a gray surface. The French word equivalent to our "cutting" is "*égriser*"—to make gray—based upon the first experiments. For a long time Holland had the entire monopoly of cutting diamonds, but finally other nations entered into competition. In 1660, during the reign of Louis XIII, Cardinal Mazarin had the first diamonds cut for the French crown. Within late years the machinery for cutting diamonds has been greatly improved, so that the Ko-hi-noor was re-cut in the space of thirty-eight days, while the cutting of the Regent had required two years.

Two styles of cutting are employed in shaping the diamond, the *rosette* and the *brilliant.* The foundation for the former is the number two multiplied by three, for the latter the number four. A complete rosette cut will cover the entire diamond with faces of equal, triangular shape, while the brilliant presents a flat surface, surrounded by facets and a deep pyramidal or conical body. Numerous combinations of faces are added to increase the action of refraction. As will readily be seen from the most usual forms of crystallization of smaller diamonds, the brilliant cut can be executed with the least loss of material. It certainly presents the stone to best advantage.

Turning aside from the historical associations of the diamond, we have yet to consider its chemical and physical properties.

Among all minerals the diamond is by far the hardest. Next to it are the various corundum species, ruby, sapphire and others. This alone, to a mineralogist, is sufficient to distinguish it. Its specific gravity is 3.5295, about the same as topaz. The index of refraction is 2.439. Expressing the power of refraction in a more tangible manner, we may say that if we have a glass lens of certain dimensions which magnifies five diameters, an equal lens of diamond would magnify eight diameters. Upon being rubbed the diamond exhibits vitreous electricity. By passing an electric spark *over* a diamond, the stone may be rendered phosphorescent, and retains this quality for a short time. This fact, probably, has given rise to the popular supposition that all diamonds must " shine " in the dark. When looking at a cut diamond it is a good plan to have a dark back-ground, as the brilliancy of the flash thereby becomes more prominent.

Diamond crystallizes in the isometric system, and shows numerous combinations. Most frequently occurring is the octahedron with many combinations. Dodecahedra are found simple and in combination. Perhaps no other mineral exhibits so many different forms belonging to the isometric system as this one. Twins and hemihedral crystals are frequently found. Characteristic of the diamond we may regard the curving of the crystalline faces. This occurs to so great a degree, that not unfrequently the specimens are nearly spherical.

Physically, we may distinguish three varieties of diamond: the crystal, the carbon and the anthracitic diamond. As seen above, the specific gravity of diamond is 3.52, while that of carbon is 3.01 to 3.40, and that of anthracitic diamond only 1.66. They show slight impurities, as compared with the crystals, but are chemically diamonds as also in their hardness. The carbon is put to practical uses, on account of its comparatively low price and great hardness. Instead of being colorless it is black, or gray, translucent only in very thin slabs.

Chemically, the diamond is carbon. At a high temperature it will burn, and be completely consumed, giving off carbonic acid gas. In an atmosphere of pure oxygen it will burn on, if once ignited. Between carbon points of a heavy battery, the diamond will become spongy, and turn to coals. In 1694 the first experiments of burning it were made. This was accomplished by means of a very powerful lens, concentrating the sun's rays. Much speculation became rife as to the behavior of diamonds under the action of great heat. Emperor Francis I, of Austria, conceived the brilliant idea of converting or melting a number of small diamonds together into one large one. In 1750 he placed a quantity of them, and some rubies, into a crucible, and subjected them to intense heat for twenty-four hours. After cooling, the rubies were found to be intact, but of the diamonds not a trace remained. Shortly before the French Revolution a Parisian jeweller asserted the possibility of exposing diamonds to a very high degree of heat without injuring them. He made his experiments before the famous chemist, Lavoisier. Maillard, the jeweller, had carefully surrounded his diamonds in the crucible with pulverized charcoal, and they withstood the fire perfectly. So long as the oxygen of the atmosphere can be excluded, the diamond cannot burn, and the only harm that might befall it would be a cracking from the heat. This, however, occurs comparatively rarely. Lavoisier, fully convinced by the demonstration, first offered a correct explanation of the phenomenon.

Impurities in diamonds are partly of a physical, partly of a chemical nature. Among the former must be classed cracks and cavities. The latter generally manifest themselves in discoloration unequally distributed. Yellow, green, brown and gray are the colors most frequently observed. According to Brewster, many of the diamonds showing cavities under the microscope afford evidence, upon polarization, of having been subjected to pressure near these cavities at the time the diamond was crystallized. Such cavities, and slight accumulations of coloring matter were at first erroneously designated as chlorophylloid substances.

Yellow and brown diamonds owe their color probably to a very minute percentage of hydrated ferric oxide. It is an expensive amusement to analyze a quantity of diamonds sufficiently great to determine this point, so we are forced to base an opinion upon other than analytical proof. In the beginning of the nineteenth century a Parisian jeweler heated a brown diamond for some time, and, upon taking it out of the crucible, found that it had burned pink. This color, however, only lasted for about ten days, when the stone turned brown again. Since that time the experiment has been repeatedly tried, often with the same result. The chemical action in this instance consisted simply in driving off the water, so that the iron was contained in the diamond as ferric oxide. This imparts a pink color. Upon exposure to ordinary atmosphere, the original hydrated ferric oxide was again formed.

Green diamonds probably owe their color to an indefinitely small quantity of ferrous oxide. Whether the Dresden diamond is colored by the same material may remain an open question. The shade of green it exhibits is not one that would probably be produced by ferrous oxide. Possibly some organic salt of iron may produce the effect of color.

Gray diamonds usually owe their lack of transparency to the presence of innumerable microscopic cavities.

What the coloring matter of the Hope diamond may be can scarcely more than be guessed at. From analogy we know that certain salts of iron, organic matter and cobalt produce the same color. Which of these it is will most likely remain a secret. At a venture, the salts of iron might seem the most probable, considering the uniformity of coloring and the shade of the blue.

Regarding the formation of diamonds much has been said and written, and many well-conceived experiments have been made. More than any other agent, heat has been employed to reproduce these treasures of nature's laboratory. Thus far all experiments have failed to attain any available result. Some of the most eminent chemists of the present century have expressed the opinion that diamonds owe their genesis not to the action of heat, but to an organic process. Newton, when studying the optical qualities of diamond, came to the conclusion that it must be a "coagulated oil." By means of electricity very minute crystals of carbon have been obtained, but all efforts to reach greater size have been baffled. Liebig regarded the formation of diamond as the result of organic decomposition. Though this view may not be perfectly tenable, it commends itself to the poetical mind from its allusion to the rejuvenated phœnix rising from his own ashes. With an ever-increasing knowledge of chemistry and the constant improvement of mechanical appliances, we may yet, some day, be able to produce diamonds that will compare favorably with those fashioned by the skillful hand of nature.

Practical uses of Diamonds.—Dependent upon its physical properties, the diamond is put to various uses. Perhaps the most prominent is that of drilling. The comparitive cheapness of "carbon" makes it possible to utilize this material for such purposes. Diamonds with sharp, crystallized edges are used for cutting glass and small fragments, and splinters are used to arm graver's tools. Dust is employed in cutting other stones as well as the diamond itself. Wherever a substance of very great hardness is required, diamond answers best. On account of its high power of refraction, diamond-lenses were formerly prepared, for the use of very high power instruments. The application of diamonds for purposes of personal or artistic ornamentation, may perhaps be considered a practical one in a certain sense. For such use the total absence of color and the high degrees of refraction and dispersion of light, place the diamond in the most prominent position among all precious stones.

Imitations.—It is natural that a stone so valuable as the diamond should frequently be imitated. Pastes are manufactured to-day, which only a very experienced eye can detect as frauds Admixtures of lead and, recently, thallium, impart to paste a high angle of refraction, thus producing "flashing" effect very near that of the diamond. Colorless quartz crystals and topaz are frequently cut and are destined to simulate diamonds. Zircon, if heated for a short time, turns colorless from a bright blood-red, and is cut. This too, in smaller settings supplies the place of the diamond.

Quartz and Zircon can readily be detected by the difference of specific gravity. The former is 2.65, the latter 4.30, while diamond is 3.52. Besides the specific gravity the hardness will be decisive, both can be scratched by topaz. Topaz is more difficult to distinguish. Its specific gravity is 3.40 to 3.65, very near that of the diamond. In this instance, as well as in those of quartz and Zircon, an optical test is the most convenient. In 1858, the Brazilian ambassador Lisboa, presented a "diamond" at the court of Vienna. It had been admirably cut in Paris, and weighed 819 carats. By experts it was valued at more than fifty millions of francs. One of the mineralogists called in consultation applied a very simple optical test, and found the stone to be a topaz. He placed a lighted candle upon a table, walked about 12 to 15 feet away from it, and looked at the light through the diamond, which he held close to his eye. In every facet *two* little flames appeared side by side. As only those crystals have single refraction, which belong to the isometric system (in which the diamond crystallizes) the specimen under question, having double refraction, could not possibly have been a diamond. When looking in this manner at a candle, the diamond, as well as the paste will show but a *single* flame in each cut face. Paste can readily be distinguished by its inferior hardness, as topaz will scratch it.

Price.—The price of diamonds is one that fluctuates, dependent upon the demand and supply. Within certain limits it may be regarded as definite, but when the value of very large stones is to be estimated, the same rules for its determination cannot be followed. Diamonds are usually separated into three classes, and they are termed as being "first water," &c. Besides these three, there is the boart and carbon. These two latter varieties are utilized for purposes of cutting, sawing, drilling, &c. They are sold by the carat as other diamonds. One carat of carbon costs about 6 dollars.

Diamonds used for purposes of ornamentation advance very rapidly in price as their size increases. If, for instance, one carat should cost 100 dollars, six carats will not cost 6 × 100 dollars, but 6 × 6 × 100 or 3600 dollars. This rule does not apply to inferior stones, but is followed, within certain limits, in determining the value of the best class of diamonds.

Independent of its high price, however, which is always a recommendation to the favor of civilized man, and woman too, the diamond will ever hold its own prominent position, on account of its great intrinsic value.